

SYSTEM FOR SEARCHING FOR DEVICE ON NETWORK

BACKGROUND OF THE INVENTION

Field of the Invention

5 The present invention relates to a system for searching for a device on a network, and particularly to a device search system for displaying a device which has been found and its location information understandably.

10 Related Background Art

Conventionally, there has been provided a method of efficiently finding and using various sources (a printer, a server unit, a scanner, etc.) connected to a network, which is called a directory service.

15 The above directory service is, in a sense, a
phone directory related to a network, which is used for
storing various types of information. As a specific
example of a directory system with the above directory
service, there is a Lightweight Directory Access
20 Protocol (LDAP), for example. Provisions of the above
LDAP are described in standard specifications, RFC
(request for comments) 1777 issued by the Internet
Engineering Task Force (IETF).

By using the above directory service to search for
25 device terminal equipments connected to a network, for
example, you can obtain a network address list of the
device terminal equipments usable on the network.

By way of example of a network printer as a
5 device, it has been desired to achieve a system capable
of notifying a user understandably of hierarchical
location information of the device such as, for
example, "where is a printer nearest my location on my
floor" or "what location in the building is a printer
0 capable of outputting a color image."

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According to one aspect, the present invention

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Fig. 5 is a diagram showing locations of
respective devices in a 2F 2-1 block;

Fig. 6 is a diagram showing locations of respective devices in a 2F 2-2 block;

Fig. 7 is a diagram showing locations of respective devices in a 1F 1-1 block;

Fig. 8 is a diagram showing locations of respective devices in a 1F 1-2 block;

Fig. 9 is a diagram showing hierarchical location information and attribute information managed by a server unit;

Fig. 10 is a diagram showing hierarchical location information and attribute information registered by a device;

Fig. 11 is a diagram showing a device search input screen;

Fig. 12 is a diagram showing an illustration of the device search input screen;

Fig. 13 is a diagram showing an example of a device search condition;

Fig. 14 is a diagram showing an example of a device search result;

Fig. 15 is a diagram showing bit maps managed by a client unit and the hierarchical location information;

Fig. 16 is a diagram showing a layout bit map managed by a client unit;

Figs. 54 and 55 are sample displays of layout bit maps according to the fourth embodiment;

Fig. 59 is a flowchart showing a process of a device according to the fourth embodiment;

Figs. 61, 62, 63 and 64 are flowcharts showing processes of a client unit according to a fifth embodiment;

Fig. 67 is a diagram showing an event notice destination registration packet of the client unit according to the fifth embodiment;

Fig. 69 is a diagram showing an event notice packet of the device according to the fifth embodiment; and

25 Fig. 70 is a diagram showing an event notice
destination table managed by the device according to
the fifth embodiment.

Embodiments of the present invention will be described in detail below by referring to accompanying drawings.

Referring to Fig. 1, there is shown a diagram illustrating a configuration of a device search system according to an embodiment of the present invention.

As shown in Fig. 1, a client unit 20, a device 30, and a server unit 10 are arranged on a network 40.

10 The client unit 20 comprises a general purpose
computer and the like, for example, having a search
module 21 for transmitting a desired device search
condition to the server unit and receiving its result
and a display module for visually displaying the
15 received search result.

The server unit 10 has a function of a directory server having a database 11 for managing attribute information of the device on the network 40. The database 11 contains registered identification information of devices on the network and information on various attributes of the devices.

The search module 12 searches for a device satisfying a device search condition from the database 11 on the basis of the device search condition received from the client unit 20 and transmits the search result to the client unit. The device attribute registration module 13 receives a device attribute from the device 30 or the like and registers it on the database 11.

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no settings of classes in the option information.

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Figs. 5 to 8 show examples of layout bit maps
5 corresponding to block classes of the hierarchical
location information, and a location of a device can be
displayed understandably by displaying these layout bit
maps on the client unit 111.

Referring to Fig. 6, there is shown a diagram of a location map in the 2-2 block on 2F. As shown in Fig. 6, the 2-2 block on 2F has a layout in which a PC 111 and a printer 103 are arranged as shown in Fig. 6.

Referring to Fig. 8, there is shown a location map
in the 1-2 block on 1F. It is understood that a
scanner 105 is arranged in a layout as shown in Fig. 8
and it is displayed on a display screen of the client

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In the fourth and fifth embodiments, a description is made for a system for understandably notifying the user of the location of the device on the network and notifying the user of status of the device. At this

5 [First embodiment]

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A search condition is inputted by using input buttons 1003 and 1004. The input button 1003 is used

Referring to Fig. 12, there is shown a diagram of an example of a search input. In this example, a device terminal equipment is a printer as attribute information and a search is executed for a device capable of color printing. Furthermore, as hierarchical location information, Floor is inputted to 1001c and 2F is inputted to 1002c, for example, for a search for a printer installed on the second floor.

In addition, when searching for a device with specifying a further detailed location on the second floor, a printer installed in block 2-1 can be searched for by inputting Block to 1001c and 2-1 to 1002c before executing the search operation, for example.

Referring to Fig. 13, there is shown a diagram representing a search condition of the above search example. It indicates a condition of a printer as a device terminal equipment (DV) capable of color printing.

At this point, it is necessary to describe how the server unit which has received the search condition formula shown in Fig. 13 evaluates the formula "FL = 2F." It is because the location condition "2F" is satisfied not only by a device installed on 2F of the

5 For a search condition formula shown in Fig. 13
for this specification, the full-path specification
from the highest class (for example, C = JP, O = ABC,
BR = Tokyo branch, etc.) is applied.

Referring to Fig. 14, there is shown an example of a search result obtained when the server unit 112 has returned a device matching the search condition shown in Fig. 13 to the client PC 111.

As a search result 1300, are set hierarchical location information 1301 to 1310 and device attribute information 1311 to 1312. If there are a plurality of devices matching the search condition, hierarchical location information 1301 to 1310 and device attribute information 1311 to 1312 of a plurality of devices are

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Referring to Fig. 20, there is shown a layout bit map displayed when a device does not have hierarchical location information or when there is no matching layout bit map in the client unit (hereinafter,

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client unit 111.

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controller 2308, the printer is connected to a network.

Nonvolatile RAM (NVRAM) 2312 retains data even if the printer 101 is turned off. In this embodiment, hierarchical location information and attribute information are stored in this NVRAM.

Figs. 25 to 29 are flowcharts of assistance in explaining processing procedures. This embodiment is described in detail below by using these flowcharts.

First, registration process of hierarchical location information of a device is described by using the flowchart in Fig. 29. As an example, the printer 101 (LBP 1110) is explained here.

The LBP 1110 retains hierarchical location information and attribute information in the nonvolatile RAM (2312) in the device. The CPU 2302 of the LBP 1110 is connected to the server unit 112 when it is turned on (step S2801). After the connection, it reads the hierarchical location information and the attribute information from the RAM (2312) of the LBP 1110 and registers them on the server unit 112 in a format as shown in Fig. 10 (step S2802).

After the registration, the CPU 2302 of the LBP 1110 releases the connection with the server unit 112 (step S2803). In this procedure, respective devices register their own hierarchical location information and attribute information on the server unit 112 after they are turned on.

Next, processes of the server unit 112 are described by using the flowchart in Fig. 25. The server unit 112 comprises an event-driven program and analyzes an event at an occurrence of the event to execute a corresponding process.

The server unit 112 opens a receiving port first when it is turned on (step S2401). Next, it obtains an event (step S2402) and judges whether or not the obtained event is an end command (step S2403). If the obtained event is the end command as a result of this judgment, the server unit closes the receiving port (step S2404) and terminates the process.

On the other hand, unless the event is the end command as a result of the judgment in step S2403, the server unit judges whether or not it is a search request (step S2405). If it is a search request, a database search process is performed in step S2406.

Unless the event is a search request as a result of the judgment in step S2405, the server unit judges whether or not it is a database registration request in step S2407. If it is the registration request as a result of this judgment, the received data is registered on the table 800 shown in Fig. 9 (step S2408). This registered data is retained in HD 211. In addition, if the event is another type of request as a result of the judgment in step S2407, other processes are performed (step S2409).

Subsequently, a data search process executed by the server unit is described in detail below by using Fig. 26.

5 In the search process, the server unit judges whether or not all the search conditions are processed in step S2501 in the search process. Until all of the search conditions are completed as a result of this judgment, this process is repeated.

10 If all the search conditions in the receiving packet are completed to be searched for in step S2501, the result is transmitted to the client unit (step S2502).

15 Unless all of the search conditions are completed to be searched for, the server unit progresses to the step S2503 to retrieve a search condition from the receiving packet. Then, the server unit judges whether all of the registered device information on the table shown in Fig. 9 are completed to be searched for regarding the search conditions (step S2504).

20 If all of the registered device information is completed to be searched for as a result of this judgment, the control returns to S2501 to retrieve the next search condition.

25 Unless all of the registered device information is searched for as a result of a judgment in step S2504, the server unit progresses to step S2505 to retrieve the nth device information from the HD 211. Then, it

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If the information matches the condition as a result of this judgment, the device information is
5 obtained (step S2507) and added to the result (step S2508).

Subsequently, a general process in the client unit
15 111 is described below.

As shown in the flowchart shown in Fig. 27, the client unit 111 obtains an event in the first step S2601. If the client unit receives an event of an end command at this point, the process is terminated directly (step S2602).

In the client unit 111, a user inputs a search
25 condition from a search condition input screen as shown
in Fig. 11. A user's click on the search start button
1005 causes the event.

At this time, the search condition formula shown
5 in Figs. 12 and 13 is used for a query to the server
terminal equipment. By storing this search condition
formula in the HD 211, this condition formula can be
used for the next search, by which a search condition
re-input by a user can be omitted.

Next, the search result display process is described in further detail by referring to the flowchart in Fig. 28.

On the other hand, unless all of the process is
25 completed as the judgment in step S2701, the control
progresses to step S2702 to obtain hierarchical
location information from the received search result.

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Referring to Fig. 33, there is shown an example of a format of an event notice to be transmitted to the client unit from the device. This event notice format 3301 is used for an event notice to the client terminal equipment at "TCP/IP:192.1.2.16:1025" when the printing job terminates, having the hierarchical location information 3302 shown in Fig. 14 being added.

15 Referring to Fig. 35, there is shown a flowchart
of a processing procedure up to a display process. As
shown in Fig. 35, after a start of an event notice
receiving process, it is judged whether or not input
information is an event notice in the first step S3501.
20 If the input information is not an event notice as a
result of this judgment, the process is terminated.

If the input information is an event notice, the control progresses to step S3502 and location information (hierarchical location information) is obtained from the received event information 3301. Then, it is judged whether or not the client unit can display a layout bit map on the basis of the obtained

In this embodiment, the hierarchical location information indicating that the device can be displayed includes the information designated by the reference numeral 1401 in Fig. 15. If the hierarchical location information does not include this, an unknown device shown in Fig. 20 is displayed (step S3510).

On the other hand, if the device terminal is judged to be able to display a layout bit map in step S3503, BL information in the hierarchical location information is obtained (step S3504). The client terminal equipment 111 displays a required layout bit map by comparing the obtained BL information with the BL information table shown in Fig. 15 (step S3505).

Next, NM information and map information are

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[Second embodiment]

Since the second embodiment is based on the first
embodiment, different portions from those of the first
embodiment will be mainly described below.

First, an operation of the client unit 111 is described with focusing on different portions from those of the first embodiment.

In the first step S5001, it is judged whether or
25 not all of the search result is completed to be
processed. If it is judged that all of the process is
completed as a result of this judgment, the process is

On the other hand, unless all of the process is completed as a result of the judgment in step S5001, the control progresses to step S5002 to obtain

Next, it is judged whether or not the map corresponding to the hierarchical location information has already been displayed (step S5005). If it has not been displayed yet as a result of this judgment, the corresponding layout map is obtained.

Referring to Fig. 51, there is shown a flowchart of a display process on the basis of an event notice received from the device by the client unit.

First, after the event notice receiving process is started, it is judged whether or not the input

If the input information is an event notice, the control progresses to step S5101 for a connection with the server unit. Next, it is judged whether or not the corresponding map has already been displayed; if the map is judged not to have been displayed yet, a corresponding layout bit map is obtained from the server unit (step S5103).

Subsequently, the client unit is disconnected from the server unit (step S5107) and event information and a job ID are obtained. After that, by displaying the
20 obtained event information and the job ID, a display as shown in Fig. 34 is achieved.

25 Referring to Fig. 52, there is shown a flowchart
of a search process of a layout bit map in the server
unit 112.

If it is a layout map search request as a result of this judgment, the control progresses to step S5202 to judge whether or not the hierarchical location information received from the client unit 111 indicates that the device can be displayed on the map. If it can be displayed as a result of this judgment, a layout bit map is loaded from the correspondence table shown in Fig. 15 in step S5203. Then, the obtained map is returned to the client unit 111 and the process is terminated.

On the other hand, if the device cannot be displayed on the map as a result of this judgment in the step S5202, the control progresses to step S5205 to display an unknown map icon shown in Fig. 21 is displayed.

In addition, unless the search request is one for a layout map as a result of the judgment in the step S5201, the control progresses to step S5206 to judge whether or not it is a device icon search request.

If it is a device bit map search request as a result of this judgment, the control progresses to step S5207 to load a corresponding device icon from the table shown in Fig. 21 and then it is returned to the client unit 111 (step S5204).

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[Third embodiment]

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as shown in the flowchart in Fig. 39.

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Next, it is judged whether or not a layout bit map corresponding to an attribute of a condition searched for in step S6003 has already been displayed. In this example, the search process has been executed with the attribute value "ABC Trading Co., Ltd." as the attribute 0, and therefore, devices as a search result are displayed on the layout bit map shown in Fig. 40 from the MAP correspondence list (shown in Fig. 38).

If the layout bit map in Fig. 40 has already been displayed as a result of the judgment in step S6003, an attribute and its attribute value of a lower class under the attribute which has been searched for are obtained from the search result in the process in step S6005. It is judged whether or not the obtained attribute value is within a range of attribute values which allow a device to be displayed in step S6006. If it is out of the range of the attribute values or any attribute value is not inputted, the device cannot be displayed and therefore the control progresses to step S6011.

In step S6011, it is judged whether or not an

On the other hand, if the attribute value is within the range of the attribute values which allow a device to be displayed as a result of the judgment in step S6006, it is judged whether or not a lower-class attribute is a map attribute (step S6007). Unless it is a map attribute as a result of this judgment, the control progresses to step S6008 to display and superpose a device icon corresponding to the NM value obtained in step S6002 in the attribute location on the displayed layout bit map. In this case, the attribute value of the class BR under the class (0) in the hierarchical location information corresponds to "Tokyo branch" (shown in Fig. 4) and therefore respective devices are displayed in locations of the Tokyo branch 5001. This results in a display as shown in Fig. 41.

The client obtains a search result from the server in the procedure described in the above embodiment.

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for searching for devices with the attribute value "ABC

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[Fourth embodiment]

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as Ready, No Paper, or Paper Jammed for each device. Each device icon information is associated with each device name (NM) and a device icon indicating Unknown for an unknown device name.

5 Referring to Fig. 54, there is shown a diagram
indicating a location of a device icon displayed and
superposed on a layout bit map. A printer 101 (LBP
1110) having location information of coordinate
information "10X + 10Y" is displayed in a form of a bit
10 map icon corresponding to the current status at the
position as shown in Fig. 54. In this example in Fig.
54, a device icon is displayed indicating that status
of the printer 101 is "No Paper."

By displaying this bit map icon together with the layout bit map, the location of the device which has been searched for and the current status of the device can be displayed understandably for a user.

Referring to Fig. 55, there is shown a layout bit map displayed on the client unit 111 after obtaining the status of the device which has been searched for. From this display, it is visually understood that the printer (LBP 1110) capable of color input or output processing is located around a table near an entrance of the block 2-1 on the second floor. Furthermore, a user is concurrently informed that the color printer 101 is currently put in the No Paper status.

Referring to Fig. 56, there is shown a flowchart

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5 described later is started (step S5703) and then the
process is terminated.

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In the above step S5801, if it is judged that there is any search result which has not been processed yet, device information (location information and attribute information) of a single device is obtained from the search result which has not been processed yet (step S5802). Furthermore, a status obtain request packet (not shown) is transmitted to an IP address included in the obtained attribute information (step S5803) and then the client unit enters a wait state for receiving a status obtain response packet as shown in Fig. 60. For example, if the search result shown in Fig. 14 is processed, the IP address is "192.1.2.1" and the status obtain request packet is transmitted to this IP address.

Subsequently, when receiving the status obtain response packet from the targeted device in step S5804, an appropriate device icon corresponding to the device status is selected out of the various device icons shown in Fig. 53 on the basis of the device name (NM) information included in the location information of the search result and the device status information of the received status obtain response packet (step S5805). For example, if the search result shown in Fig. 14 is processed, device name information is "LBP 1110." If

Next, it is judged whether or not the client unit
111 can display the layout bit map corresponding to the
block (BL) information as location information, in
other words, whether or not it stores the layout bit
map information corresponding to the block (BL)
information by using the information table shown in
Fig. 15 (step S2906). In this embodiment, the location
information which allows the client unit to display a
layout bit map is location information including the
information designated by 1401 in Fig. 15. Unless the
location information includes this, it is judged
whether or not an unknown map has already been
displayed as shown in Fig. 20 (step S5810).

If the unknown map has not been displayed yet, the unknown map is displayed in the area 1901 shown in Fig. 20 (step S5811). After that, the device bit map icon selected in the above step S5805 is displayed in the area 1902 shown in Fig. 20 (step S5812). In this case, the layout map has not been normally displayed. In other words, an icon of a device whose location information has not been registered yet is displayed here.

On the other hand, if it is judged that the client unit can display the layout bit map in the step S5806,

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Referring to Fig. 62, there is shown a flowchart
5 of a search request transmission process in the step
S6104 shown in Fig. 61. This process is the same as
the process described in the fourth embodiment.

In Fig. 63, as a result of the device search, it is judged whether or not one or more devices satisfying the search condition are found (step S6301). If there is no device satisfying the search condition, the client unit displays a message (not shown) indicating that the specified device is not found (step S6315) and terminates the process.

On the other hand, if it is judged that one or more devices are found in the step S6301, the search result (location information and attribute information of the corresponding devices) is stored in a hard disk 211. For example, if a search result as shown in Fig. 14 is obtained, it is stored in the hard disk 211. After that, a status obtain process comprising the subsequent processes beginning with the process of the step S6303 is executed for each search result stored in the hard disk 211.

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On the other hand, if it is judged that the client

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Next, an operation of the event notice receiving process shown in the step S6108 in Fig. 61 is described in detail below by using a flowchart of Fig. 64.

As shown in Fig. 69, each device monitors a status
15 change of itself and at an occurrence of an event
satisfying the notice condition registered from the
client unit 111 it transmits information of the event
to the notice destination registered from the client
unit 111. At this time, the location information
20 stored in the device is also transmitted in a packet
together as a representation of the device location.
An example in Fig. 69 shows a packet transmitted at an
occurrence of an event of "No Paper" in the color
printer 101 (LBP 1100).

25 Next, the client unit 111 judges whether or not
there is device information having information matching
the location information obtained from the above event

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For example, if "Ready" as device status information is transmitted from the color printer 101 as a response to an event notice destination registration process which has been executed and further the "No Paper" event has occurred in the color printer 101 in a state that a device icon indicating the "Ready" status is displayed on the screen, the device icon indicating the "Ready" status is changed to an icon indicating the "No Paper" status as shown in Fig. 55 on the screen display.

The color printer 101 opens a receiving port for receiving an event notice destination registration packet as shown in Fig. 67 from the client unit 111 after being turned on, by which it enters a receivable status (step S6501). After that, when receiving an event notice destination registration packet from a search client PC (step S6502), the color printer stores a notice condition and notice destination information included in the event notice destination registration packet in the event notice destination table as shown

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